ABSTRACT

Han, Seungwoo. Ph.D., Purdue University, May, 2005. Application Modeling of the Conventional and the GPS-Based Earthmoving Systems. Major Professor: Daniel W. Halpin.

A GPS-based earthmoving system for construction, which is the state–of-the art in earthmoving, was created in 1998 and has continued to be developed since that time. This new technology is currently being applied to many construction fields, bringing many advantages over conventional systems, such as more efficiency, better performance, and safety. As this application of the GPS system has been broadly extended to many jobsites rapidly, planners faced the challenge of determining whether the conventional system or the GPS-based system is more applicable under specific job conditions in the project planning phase. One of the major methods to help them determine this subject is to estimate and compare the productivity of each system, which is a basic criterion for the evaluating performance of construction activities.

The studies for accurate assessment of earthmoving productivity focused on a single evaluation model, being either a deterministic model or a simulation model. The deterministic model cannot address the random and dynamic nature of earthmoving operations; and although a simulation model can overcome these limitations, the difficulty in implementing simulation has greatly restricted it from being applied widely in the industry. Additionally, there is no current reference for evaluating the productivity of the GPS-based systems because of their new technology state.

The goal of the current research is to create and develop an application model for predicting the productivity of the conventional and the GPS-based earthmoving systems using appropriate tools. In the first phase of this research, more precise and reasonable datasets are generated using a simulation methodology, WebCYCLONE, which is conducted based on actual data collected from

the selected jobsites using the full factorial experimental design method. The application model based on two decision-making tools (e.g. a multiple regression model and an artificial neural network) is presented in the second phase to provide appropriate productivity estimations for each different site condition, as well as evaluation of the application model through a case study.